REMARKS

Applicants respectfully traverse and request reconsideration.

AMENDMENTS

Claims 12, 17-18 and 20-22 have been cancelled without prejudice. Claim 8 has been amended to include the limitations previously presented in original claim 12. Claim 19 has been amended to properly depend upon claim 23. Claim 23 has been amended to correct a typographical error and to clarify the claimed subject matter. Claim 23 now provides that the tile has a location and that the cache MinZ and the cache MaxZ are associated with the location of the tile. Claim 26 has been amended to correct typographical errors.

REJECTIONS UNDER 35 U.S.C. § 101

Claims 1-15 and 26-29 stand rejected under 35 U.S.C. § 101 because the claimed invention is allegedly directed to non-statutory subject matter. As noted, Claim 12 has been cancelled without prejudice. The Office Action solely discusses this rejection in ¶ 2. But for the identification of which claims currently stand rejected under § 101, the Office Action merely states that:

> [w]hile Abstract ideas, natural phenomena and laws of nature are not eligible for patenting, methods and products employing abstract ideas, natural phenomena, and laws of nature to perform a real-world function may well be. For claims including such excluded subject matter to be eligible, the claims, must be for a practical application of the abstract idea, law of nature, or natural phenomenon. Diehr, 450 U.S. at 187, 209 USPQ at 8 ("application of a law of mature or mathematical formula to a known structure or process may well be deserving or patent protection."); Benson, 409 U.S. at 71, 175 USPQ at 676 (rejecting formula claim because it "has no substantial practical application"). To satisfy section 101 requirements, the claim must be for a practical application of the § 101 judicial exception, which can be identified in various ways: the claimed invention "transforms" an article or physical object to a different state or thing; the claimed invention otherwise produces a useful, concrete and tangible result.

In other words, the Office Action provides no explanation as to why the aforementioned claims allegedly constitute non-statutory subject matter. In contrast, the Office Action recites and characterizes case law while proffering one example of compliance with the § 101 requirements of the Patent Act.

Applicants object to this rejection for at least the reason that no explanation has been given as to why the aforementioned are allegedly non-statutory. Accordingly, a *prima facie* case has not been established. Applicants kindly remind the Office that MPEP § 2106(II)(A) expressly states that "Office personnel have the burden to establish a *prima facie* case that the claimed invention as a whole is directed to solely an abstract idea or to manipulation of abstract ideas or does not produce a useful result. Only when the claim is devoid of any limitation to a practical application in the technological arts should it be rejected under 35 U.S.C. § 101. Further, when such a rejection is made, Office personnel must expressly state how the language of the claims has been interpreted to support the rejection." (Emphasis added, citations omitted).

Applicants respectfully submit that reciting and characterizing case law does not rise to the level of establishing a *prima facie* case that the claimed invention, as a whole, is solely direct to an abstract idea without the production of a useful result; no application of case law to the claimed subject matter has been presented. Nor does the recitation and characterization of case law provide any explanation as to how the claim is devoid of any limitation to a practical application in the technological arts; no application of case law to the claimed subject matter has been presented. Finally, the recitation and characterization of case law fails to expressly state how the language of the claims have been interpreted to support the rejection; no application of case law to the claimed subject matter has been presented. Subsequently, the rejection is improper. For this reason, if the Examiner maintains this rejection, or complies with the MPEP

and issues a proper § 101 rejection in the next Office Action, Applicants respectfully request that the rejection be non-final.

In any event and solely for the purpose of expediting prosecution, Applicants respectfully submit that at least independent claims 1, 8 and 27 recite statutory subject matter. In each of these claims a determination is made that is concrete (e.g., is repeatable), useful (e.g., has practical utility) and has a real world, tangible result. For example, in claim 1, Applicants present a method for hierarchical Z buffering and stenciling comprising, among other things, "determining whether to render a plurality of pixels within the tile based on the comparison of the tile Z value range with the hierarchical Z value range and the stencil code." (Emphasis added). Similarly, in claims 8 and 27, Applicants present methods for hierarchical Z buffering and stenciling that comprises, among other things, determining if the tile is visible relative to a stencil and determining if the tile is visible in a hierarchical Z plane. Finally, Applicants note that both claims 1 and 8 further require that the updating of the hierarchical Z value range and the stencil code.

The MPEP states that "[f]or such subject matter to be statutory, the claimed process must be limited to a practical application of the abstract idea or mathematical algorithm in the technological arts. ... A claim is limited to a practical application when the method, as claimed, produces a concrete, tangible and useful result; i.e., the method recites a step or act of producing something that is concrete, tangible and useful. ... Likewise, a machine claim is statutory when the machine, as claimed, produces a concrete, tangible and useful result (as in *State Street*, 149 F.3d at 1373 ...)...." MPEP § 2106(IV)(B)(2)(b)(ii). However, the analysis is the same regardless of whether the claim is directed to a machine or a process. MPEP § 2106(IV)(B)(2).

In *State Street*, the Federal Circuit reviewed a claim directed to a "data processing system for managing a financial services configuration of a portfolio established as a partnership, each partner being one of a plurality of funds, comprising" a variety of structural components including a "fifth means for processing data regarding aggregate year-end income, expenses, and capital gain or less for the portfolio and each of the funds." 149 F.3d 1368, 1371-72 (Fed. Cir. 1998). The Federal Circuit held that:

> [t]he transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces 'a useful, concrete and tangible result' – a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades. *Id.*, at 1373; *See also* MPEP § 2106(IV)(B)(2)(a).

Notably, the claim did not require that the claimed result was recorded, accepted and/or relied upon. Thus, at least according to the Federal Circuit, a claim need not expressly recite a result that is useful, concrete and tangible in order to be considered statutory subject matter. The fact that the claim led to or allowed for a recorded, accepted and/or relied upon result was sufficient to establish compliance with 35 U.S.C. § 101.

While method claims take a different form than a machine claim, the fact that Applicants claim methods and not machines, as presented in *State Street*, has no impact on the present analysis. *See* MPEP § 2106(IV)(B)(2) (expressly stating that "[f]or the purposes of a 35 U.S.C. § 101 analysis, it is of little relevance whether the claim is directed to a machine or to a process[; t]he legal principles are the same."). Consequently, the fact that the *State Street* opinion notes that the claim is directed to a machine has no weight on the instant analysis.

With respect to claim 1, the method for hierarchical Z buffering and stenciling requires determining whether to render a plurality of pixels associated with a tile, for example, for display

and thus produces a useful, concrete and tangible result. Like the claimed invention in *State Street*, Applicants' claim 1, directed to a method for hierarchical Z buffering and stenciling, results in a determination that may be recorded, accepted and/or relied upon. For example, if the determination is positive, this determination may be relied upon to render a plurality of pixels. Alternatively, if the determination is negative, this determination may be relied upon, for example, to not render a plurality of pixels. For at least this reason, claim 1 appears to be directed to a practical application of the § 101 judicial exception.

With respect to claims 8 and 27, other determinations are made that may also be recorded, accepted and/or relied upon in a similar fashion. For at least these reasons, claims 8 and 27 are also believed to constitute statutory subject matter. Dependent claims 2-7, 8-11, 13-15, 26 and 28-29 are believed to also be directed to statutory subject matter for the same or similar reasons as provided above.

REJECTIONS UNDER 35 U.S.C. § 103(a)

Claims 1–15 and 17-29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable in view of U.S. Patent Publication No. 2005/0134588A1 to Aila et al. ("Aila") in view of U.S. Patent No. 5,579,455 to Greene et al. ("Greene"). As noted above, claims 12, 17-18 and 20-22 have been cancelled without prejudice solely in order to advance prosecution. Accordingly, Applicants reserve the right to file additional claims or continuing applications direct to the subject matter previously presented in the presently cancelled claims.

Claims 1-7, and 23-29 and 19

Independent claim 1 requires, among other things, "comparing a tile Z value range of a tile with a hierarchical Z value range and a stencil code" and "determining whether to render a plurality of pixels with the tile based on the comparison ...." Independent claim 23 requires,

among other things, comparing "the tile MinZ and the tile MaxZ to the cache MinZ and the cache MaxZ", "wherein the cache MinZ and the cache MaxZ are associated with the location of the tile." Independent claim 27 requires, among other things, "determining if the tile is visible in a hierarchical Z plane by comparing a MinZ and a MaxZ for the tile to a hierarchical Z range." In other words, each of independent claims 1, 23 and 27 require the comparison of at least two z-values associated with a tile with a hierarchical Z range or at least two cache z-values. In independent method claims 1 and 27, the comparison is used to determine whether to render the pixels or to determine whether the tile is visible. As appreciated, the hierarchical Z value range and/or the at least two cache z-values may be stored in, for example, a Z or depth buffer. In the last response, Applicants explained that unlike the claimed subject matter, Greene always compares the Z-max value and the Z-min value of the Z-pyramid to the same z-value of the primitive (i.e., the z-value representing the nearest depth of the primitive).

In response thereto, the Office Action appears to suggest that Greene is not so limited. Citing column 14, lines 48-62, the Office Action states that:

> Greene et al. teaches that <u>for each such Z-max element, the depth value which is written into that element is the farthest depth value</u> in any of the Z-max elements which are covered by such Z-max element[s] in the next finer granularity level. If the depth buffer 502 also includes Z-min elements, then the inner iteration also visits each of the Z-min elements in the current level. <u>For each such Z-min element, the depth value which is written into that element is the nearest depth value</u> in any of the Z-min elements which are covered by such Z-min element in the next finer granularity level.... It is further noted that said farthest and nearest depth values are considered different z-values (i.e., different range) of a given primitive.

In other words, the Office Action appears to interpret Greene as teaching the comparison of a Z-max value and a Z-min value of a Z-pyramid with different z-values of a given primitive. With respect to method claims 1 and 27, this is incorrect as Greene does not teach making such a comparison to either determine "whether to render a plurality of pixels with the tile" or "if the

tile is visible." With respect to graphics processing engine claim 23, this is also incorrect as Greene does not teach making such a comparison where the cache MinZ and cache MaxZ are associated with a same location as the tile. For these reasons, the rejection is improper and must be withdrawn. Further explanation is provided below with respect to each of claims 1, 23 and 27.

Applicants initially refer to FIGs. 6-8 to illustrate the basic teachings of the Greene reference in view of the Office Action's citation to column 14. "FIG. 6 is an overall flowchart of a procedure which may be used to implement the present invention [of Greene]" and illustrates how "sequential frames from an initial list of primitives" are rendered". (Col. 11, ll. 51-52 and 62-63). In step 608 a depth buffer is initialized. The depth buffer appears to be a Z-pyramid as shown in FIG. 5 where the buffer or pyramid has multiple levels of granularity. "In the finest granularity level 504, the depth buffer has a 'depth element' 512 corresponding to each of the display cells 204 [associated with the corresponding display]. Each of these depth elements contains a 'depth value', indicating the depth of the surface cell whose color was most recently written to the display element 302 corresponding to the same display cell 204 (e.g., a pixel) to which the depth element 512 corresponds. Thus, the first-level 504 of the depth buffer 502 is substantially the same as a conventional depth buffer. (Col. 10, ll. 18-27). In the immediately coarser level, a smaller number of depth elements are present, where each depth element also is associated with a depth value. Thus, the depth elements in the coarser level are said to cover two or more depth elements in the level below it. "The depth value contained in each of ... [these] depth elements ... is the same as the farthest depth value contained in any of the depth elements which it covers in ... [the immediately finer level]." (Col. 10, ll. 28-38). Depth values in each of the levels are called Z-max elements because they represent the maximum z-value for all display

cells covered by that depth value. The depth value in the lowest or finest level is also called a Z-max element even though it may only contain one value associated with the one display cell. (Col. 10, ll. 38-44).

Returning to step 608, the depth buffer is initialized by writing the farthest depth value into all depth elements of all levels of the buffer. The farthest depth value appears to be the largest number representable in the computer memory space. (Col. 12, ll. 9-15). After other initializations, the frame is rendered in step 612 as shown in FIG. 7 and 8. Step 716 of FIG. 7 calls a "render primitive" routine for all primitives associated with octree nodes in temporal coherence list. This process is illustrated in FIG. 8, and specifically in step 806, where this "'render primitive' routine ... writes the corresponding depth values of the visible surface cells into only the finest level of the depth buffer 502." (Col. 12, ll. 58-64). Thereafter, the process continues in step 719 where the depth buffer 719 is built. This process is articulated in column 14, ll. 48-62 of Greene, the same reference of Greene that allegedly teaches comparing tile z-values or a hierarchical z-values with primitive z-values. As articulated below, this is a improper characterization of Greene.

After step 806, the finest granularity level of the Z-buffer has depth values written to each depth element. In step 719, the remainder of the depth buffer, from the second finest granularity level to the coarsest granularity level, is built. Green teaches that this is an iterative process. Starting at the second finest granularity level, the process writes a depth value (a Z-max element) to each depth element by visiting each depth element in the immediately finer granularity level covered by the depth element in the current level. "For each such Z-max element [e.g., the current depth element in the current level], the depth value which is written into that element is the farthest depth value in any of the Z-max elements [e.g., the depth elements] which are

covered by such Z-max element in the next finer granularity level." (Col. 14, ll. 53-56). Greene further teaches that the Z-buffer may also contain a second depth value associated with a minimum z value. "[E]ach of the depth elements 512 can contain not only a Z-max element having the farthest depth of any display cell covered by the depth element 512, but also a Z-min element containing the nearest depth value of any of the display cells 204 covered by the depth element 512." (Col. 11, ll. 7-13). Thus, "[i]f the depth buffer 502 also includes Z-min elements, then ... [for] each such Z-min element, the depth value which is written into that element is the nearest depth value in any of the Z-min elements which are covered by such Z-min element in the next finer granularity level." (Col. 14, ll. 56-62). Greene notes that if Z-min elements are also stored, the depth value in each depth element of the finest granularity level is both a Z-max element and a Z-min element. (Col. 14, l. 62 – Col. 15, l. 6). In other words, Greene teaches that comparisons yielding the depth value with the farthest depth and the nearest depth actually compare display cells with different locations.

After the depth buffer is built, the frame is rendered and displayed. (*See generally*, steps 722-726). This process may include FIGs. 15-20, 12 and 14. For example, the"process octree" step of Fig. 7 (Step 722) includes processing the octree node (step 1502 of FIG. 150) illustrated in more detail in FIGs. 16-19. Part of processing the octree node includes, for nodes not already rendered and for such nodes bounding cubes that interest the viewing frustrum, proving whether such cube is hidden (*See* FIG. 16, steps 1602-1605, FIG. 17) and determining whether primitives associated therewith are hidden. (FIG. 17, step 1706, FIGs. 18-19). To determine whether primitives are hidden, a determination is made as to the finest granularity level of the Z-buffer that fully covers the primitive (step 1802). Then the "nearest depth of the point on the primitive [that] is the nearest vertex of the polygon" is determined. (Col. 17, ll. 2-3; Step 1804).

Subsequently (and as previously articulated by Applicants in the last response), the primitive is proved hidden by iteratively starting with the previously determined finest granularity level of the Z-buffer and "deciding whether the Z-max value in the covering depth elements ... is nearer than the [previously determined] nearest depth of the primitive". (Col. 17, ll. 27-28). If so, then the primitive is hidden. If not, then the depth buffer compares the Z-min value to the <u>same</u> nearest depth of the primitive to determine if the primitive is at least partially visible. The interative process may be repeated at other granularity levels if necessary. (Col. 17, ll. 28-50).

<u>Claims 1 and 27</u>

Applicants respectfully note that the cited portions (i.e., Col. 14, ll. 48-62) of the Greene reference do not teach or suggest what the Office Action alleges. As previously stated, method claims 1 and 27 make comparisons to determine whether to render a plurality of pixels or to determine if the tile is visible. At no point in the cited portions does Greene teach or suggest comparing the a tile Z value range of a tile with a hierarchical Z value range or comparing a MinZ and a MaxZ for the tile to a hierarchical Z range to determine whether to render a plurality of pixels or to determine if the tile is visible. Instead, the alleged comparison in column 14, ll. 48-62 of Greene is merely used to build a Z-buffer and the various levels thereof. A different comparison (Col. 17, ll. 23-40) is used to determine if a primitive is hidden. This different comparison, as noted above, compares the same "nearest point of a primitive" to a Z-max value of the Z-buffer and to the Z-min value of the Z-buffer. Because the <u>same</u> point in the primitive of interest is compared to a maximum and minimum Z-value in a depth buffer, Greene fails to teach or suggest the limitations present in Applicants' method claims.

<u>Claim 23</u>

Although Applicants traverse and disagree with the Examiner with the proposition that a tile MinZ and a tile MaxZ are being compared to a cache MinZ and a cache MaxZ, Applicants note that the clarifying amendment removes all reasonable comparisons between Applicants' claimed subject matter and the cited portions of Greene. As currently presented, Applicants note that claim 23 requires, among other things, that the tile has a location and a comparator compares "the tile MinZ and the tile MaxZ to the cache MinZ and the cache MaxZ", "wherein the cache MinZ and the cache MaxZ are associated with the location of the tile." The Greene reference appears to compare covered Max-Z elements of depth elements in a common level of a Z-buffer and also appears to compare covered Min-Z elements of depth elements in the same common level of the Z-buffer. Based on these comparisons, Greene populates fields (i.e., Max-Z elements and Min-Z elements) in a coarser level of the depth buffer. Applicants note that when Greene compares Max-Z elements of depth element in a common level of the Z-buffer, it is not comparing a tile MaxZ associated with a tile having a location with a cache Max Z associated with the location of the tile. Instead, Greene compares one Max-Z element associated with one display element having a first location to one or more second Max-Z elements associated with one or more other display elements having respective different locations. Similarly, Greene compares one Min-Z element associated with one display element having a first location to one or more second Min-Z elements associated with one or more other display elements having respective different locations. Thus, Applicants respectfully submit that Greene fails to teach or suggest Applicants' claimed subject matter.

Dependent Claims 2-7, 19, 24-26 and 28-29

Applicants respectfully note that dependent claims 2-7, 19, 24-26 and 28-29 contain additional novel, non-obvious and patentable subject matter and are therefore also in condition for allowance for at least the same reasons as their respective base claims.

Claims 8-11, 13-15

Claim 8

Claim 8 contains subject matter that is not identical to that of claim 1. In the previous response, Applicants noted that that because "the claim language of claim 1 is different than the claim language of claim 8, ... the scope of claim 1 is different than the scope of claim 8. For this reason alone, claim 8 is believed to be allowable over the cited prior art." (p. 18). However, the previous and current Office Actions merely point to the rationale articulated by the Examiner with respect to Claim 1. Applicants note that this is in error. If this rejection is maintained, Applicants respectfully request the issuance of a non-final Office Action that clearly identifies those portions of the cited prior art that teach or suggest each claim limitation of claim 8.

In order to advance prosecution, however, Applicants note that claim 8 has been amended to include the limitations of previously submitted claim 12. The Office Action rejected these limitations by merely citing to page 9, ¶¶ 102 and 106 of Aila. No other explanation was given. Applicants respectfully submit that the cited portions of Aila fail to teach or suggest a stencil code as a multiple-bit indicator which specifies a relation of a plurality of stencil values in the tile relative to a background value. At best, the cited portion of the reference merely teaches that a four-bit stencil value could be used to reduce "cost" per tile. Applicants note that the claimed stencil code is not the same as a stencil value. Because Aila fails to teach or suggest both a stencil code and a stencil value as expressly required by the claim, Applicants submit that claim 8 is in proper condition for allowance.

Claims 9-11 and 13-15

Applicants respectfully note that dependent claims 9-11 and 13-15 contain additional novel, non-obvious and patentable subject matter and are therefore also in condition for allowance for at least the same reasons as claim 8. Applicants additionally note that claim 13 contains limitations similar in nature to those presented above with respect to claims 1, 23 and 27. Accordingly, claim 13 is also believed to be allowable over the cited prior art for those reasons articulated above with respect to claims 1, 23 and 27.

Applicants respectfully submit that the claims are in condition for allowance and respectfully request that a timely Notice of Allowance be issued in this case. The Examiner is invited to contact the below listed attorney if the Examiner believes that a telephone conference will advance the prosecution of this application.

Respectfully submitted,

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